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FLOOD INSURANCE STUDY



CITY OF MONDOVI,
WISCONSIN
BUFFALO COUNTY



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DECEMBER 1, 1980



federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 550031

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PUBLISHED SEPARATELY:
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF MONDOVI,
BUFFALO COUNTY, WISCONSIN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Mondovi, Buffalo County, Wisconsin, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Mondovi to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Carl C. Crane, Inc. for the Federal Insurance Administration under Contract No. H-4785. This study was completed in June 1979.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, the FIA, the Wisconsin Department of Natural Resources and representatives of the City of Mondovi on April 18, 1978. Results of the hydrologic analyses were coordinated with the Wisconsin Department of Natural Resources, Flood Plain Management Section.

On June 18, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, the FIA, and community officials.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Mondovi, Buffalo County, Wisconsin. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through June 1984.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and the City of Mondovi.

The flooding sources studied by detailed methods are listed below:

- a. the Buffalo River, approximately 3.0 miles, from the southern limit of flooding (0.16 mile downstream of the southern corporate limit) to the eastern corporate limit;
- b. Peeso Creek, approximately 2.0 miles, from its mouth at the Buffalo River to just upstream of the northern corporate limit; and
- c. Brownlee Creek, approximately 0.35 mile, from its mouth at Mirror Lake to the northern corporate limit.

An approximate study was completed for 0.85 mile of Harvey Creek in southwest Mondovi.

2.2 Community Description

The City of Mondovi is located in the west-central portion of Wisconsin in the northeastern portion of Buffalo County. The upland areas of the county around the City of Mondovi are generally covered with silt loams, while the valley bottoms are covered with sandy loams of alluvial origin. It is southwest of Eau Claire, Wisconsin and is bordered on all sides by the unincorporated areas of Buffalo County. The total land area contained within the city limits is approximately 3.0 square miles. Mondovi was incorporated in 1889. In 1970 its population was listed as 2,338 as obtained from the 1973 State of Wisconsin Blue Book (Reference 1). About 25 percent of the total acreage is in residential use, with approximately 5 percent in recreational use, 60 percent open lands, and the remainder in all other area uses (including commercial, industrial, and transportation).



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APPROXIMATE SCALE



VICINITY MAP

FIGURE 1

The climate in west-central Wisconsin is characterized by wide variations in temperatures. Average summer and winter temperatures for the years 1969 to 1973 ranged from 73 degrees Fahrenheit (F.) and 7 degrees F. respectively. Annual average precipitation of the region is 30.0 inches with an average recorded snowfall of 48 inches. Precipitation is normally higher in the spring and summer months (References 1 and 2).

The Buffalo River flows southwesterly through the city and has a drainage area of approximately 218 square miles upstream of the corporate limits. Brownlee and Peeso Creeks both flow southerly through the city and have drainage areas of 4.1 and 14.1 square miles respectively. Development in the flood plains is primarily residential.

2.3 Principal Flood Problems

The history of flooding on the streams within the City of Mondovi indicates that flooding may occur during any season of the year. Most major floods on the Buffalo River have occurred in the early spring and summer and are usually the result of snowmelt and spring rains.

Both Brownlee Creek and Peeso Creek have smaller drainage basins and, therefore, are much more susceptible to locally heavy rains. Floods can occur on these creeks during any of the warmer months.

The Buffalo River near Tell, Wisconsin, has gage records available for the years 1933 through 1950. Due to the age of the records and to the large differences in drainage areas (218 square miles versus 406 square miles), it was concluded that the recorded flood stages would not necessarily be reflective of local flooding conditions in Mondovi.

2.4 Flood Protection Measures

The Mill Street Dam, located at the outlet of Mirror Lake, is the only flood control measure in Mondovi and provides only minimal protection to shoreline owners upstream of the structure.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the

same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

For the detailed study of the Buffalo River, Brownlee Creek and Peeso Creek, the hydrologic analysis was investigated utilizing the States Multiple Regression Equations with drainage area, main channel slope, percent lakes and marsh, areal factor, and mean snowfall as the independent variables (Reference 3). The derivation of these equations is described in detail in Estimating Magnitude and Frequency of Floods in Wisconsin by Duane H. Conger (Reference 3).

For the detailed studies of Brownlee Creek and Peeso Creek, the hydrologic analysis was also investigated, utilizing the methodology outlined in the U.S. Department of Agriculture, Soil Conservation Service (SCS), National Engineering Handbook (Reference 4). Using this procedure, the time of concentration and time of peak is computed for the basin and a unit hydrograph is developed. The expected 6-hour rainfall for the desired frequency event was obtained from Technical Paper No. 40 (Reference 2), and distributed into 30-minute amounts as described in the SCS criteria for design storms. A 6-hour duration storm was chosen since it was determined to be the "effective duration" for areas having an average annual precipitation of approximately 30 inches.

Rainfall excess was computed from accumulated rainfall, using an SCS runoff equation which equates runoff as a function of soil type, antecedent moisture condition, and land use (Reference 5). Utilizing this precipitation data and the derived unit hydrograph, an outflow hydrograph was computed for the basin.

The results of these studies of peak discharges were compared with data obtained from similar gaged basins. These discharges reflect the present land use within the basin. Increased development without regard to changes in the runoff characteristics of the basin would substantially increase these flows.

Overtopping of the West Bank of Mirror Lake will occur for floods having recurrence intervals exceeding once every 50 years. This outflow will be diverted by the local streets and storm sewers around the Mill Street Dam. Some of this flow will eventually be carried directly into the Buffalo River. The lake stages computed in this study assume this overtopping condition is left unhindered.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
BUFFALO RIVER					
At southern corporate limit	218	6,000	10,000	12,000	16,000
PEESO CREEK					
Above Mirror Lake	14.1	1,200	2,400	3,000	4,800
Below Mirror Lake	18.2	1,700	3,400	3,600	5,650
BROWNLEE CREEK					
Mouth at Mirror Lake	4.1	500	950	1,200	2,000

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross sections, bridge elevation data, and structural geometry for the backwater analyses of all three creeks were obtained by field surveys by the Study Contractor. The channel soundings were also obtained by field measurements.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The roughness value for the main channel of the Buffalo River was 0.035, with flood plain roughness values ranging from 0.09 to 0.11 for all floods. The roughness value for the main channel of Brownlee Creek was 0.040, with flood plain roughness 0.080 for all floods. The roughness value for the main channel of Peeso Creek was 0.04, with flood plain roughness ranging from 0.080 to 0.11 for all floods.

Starting water-surface elevations for each flood frequency studied for the Buffalo River and Peeso Creek below Mirror Lake were computed using the computer program hydraulics of bridge waterways (Reference 6). Starting elevations for Brownlee Creek and Peeso Creek above Mirror Lake were taken from the appropriate lake stages computed from the Mirror Lake dam rating curve.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the U.S. Army Corps of Engineers (COE) HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

All profiles of the final water-surface were compared with available high water marks. These high water marks were found to be consistent with the profiles that were developed as a part of this study.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to

indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using USGS topographic maps enlarged to a scale of 1:4800, with a contour interval of 20 feet (Reference 8). Boundaries for Harvey Creek, studied by approximate methods, were determined using the Flood Hazard Boundary Map (Reference 9), topographic maps (Reference 8) and engineering judgement.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. However, the Wisconsin Department of Natural Resources has established a policy that limits encroachment in the flood plain to 0.1 foot (Reference 10). The floodways in this study were developed utilizing the existing effective flow limits. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
BUFFALO RIVER							
A	30.36	1086	6412	1.9	777.3	777.3	0.0
B	30.68	1341	6139	2.0	778.5	778.5	0.0
C	31.00	465	2903	4.1	780.4	780.4	0.0
D	31.20	1013	6712	1.8	782.0	782.0	0.0
E	31.47	939	5435	2.2	782.7	782.7	0.0
F	31.66	198	2368	5.1	783.8	783.8	0.0
G	31.92	1352	7870	1.5	786.3	786.3	0.0
H	32.26	1792	6955	1.7	787.4	787.4	0.0
I	32.66	2103	8708	1.4	789.4	789.4	0.0
J	33.22	2690	11,150	1.1	791.3	791.3	0.0
PEESO CREEK							
A	0.25	245	1273	2.8	787.9	787.9	0.0
B	0.50	75	1095	3.3	791.4	791.4	0.0
C	0.64	121	968	3.7	792.0	792.0	0.0
D	1.15	440	2156	1.4	813.5	813.5	0.0
E	1.31	428	1337	2.2	816.7	816.7	0.0
F	1.59	368	1468	2.0	818.4	818.4	0.0
G	1.81	359	1301	2.3	820.8	820.8	0.0
H	2.03	415 ²	1036	2.9	824.2	824.2	0.0
BROWNLEE CREEK							
A	0.10	22	158	7.6	813.5	813.5	0.0
B	0.33	233	352	3.4	815.9	815.9	0.0
C	0.35	236	378	3.2	817.3	817.3	0.0

¹MILES ABOVE MOUTH

²THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

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FLOODWAY DATA

BUFFALO RIVER - PEESO CREEK - BROWNLEE CREEK

TABLE 2

increasing the water-surface elevation of the 100-year flood more than 0.1-foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

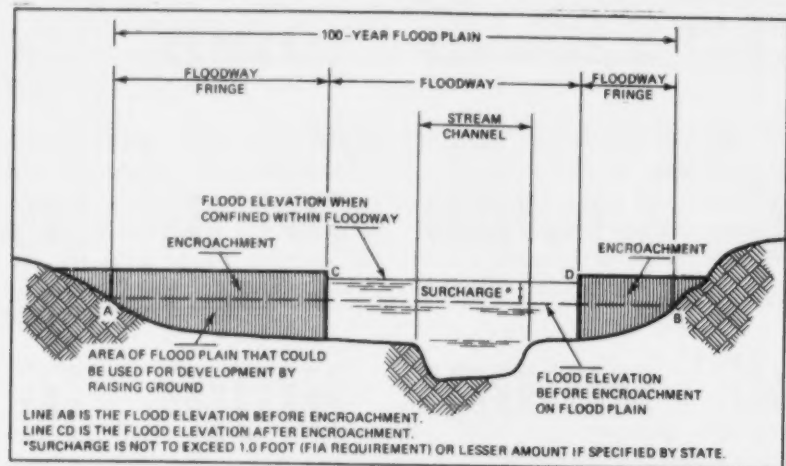


FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the City of Mondovi.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

<u>Average Difference Between 10- and 100-year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Mondovi are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire incorporated area of the City of Mondovi was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHF's determined.
Zones A4, A5:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to

certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Mondovi is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

No previous studies exist in the general vicinity of the City of Mondovi at the time of this report.

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 9). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, One North Dearborn Street, Chicago, Illinois 60602.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
BUFFALO RIVER REACH 1	0001	-2.4	-0.7	1.3	025	A5	VARIES-SEE MAP
PEESO CREEK REACH 1	0001	-2.3	-0.6	1.5	025	A5	VARIES-SEE MAP
BROWNLEE CREEK REACH 1	0001	-2.0	-0.5	1.5	020	A4	VARIES-SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

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CITY OF MONDOVI, WI

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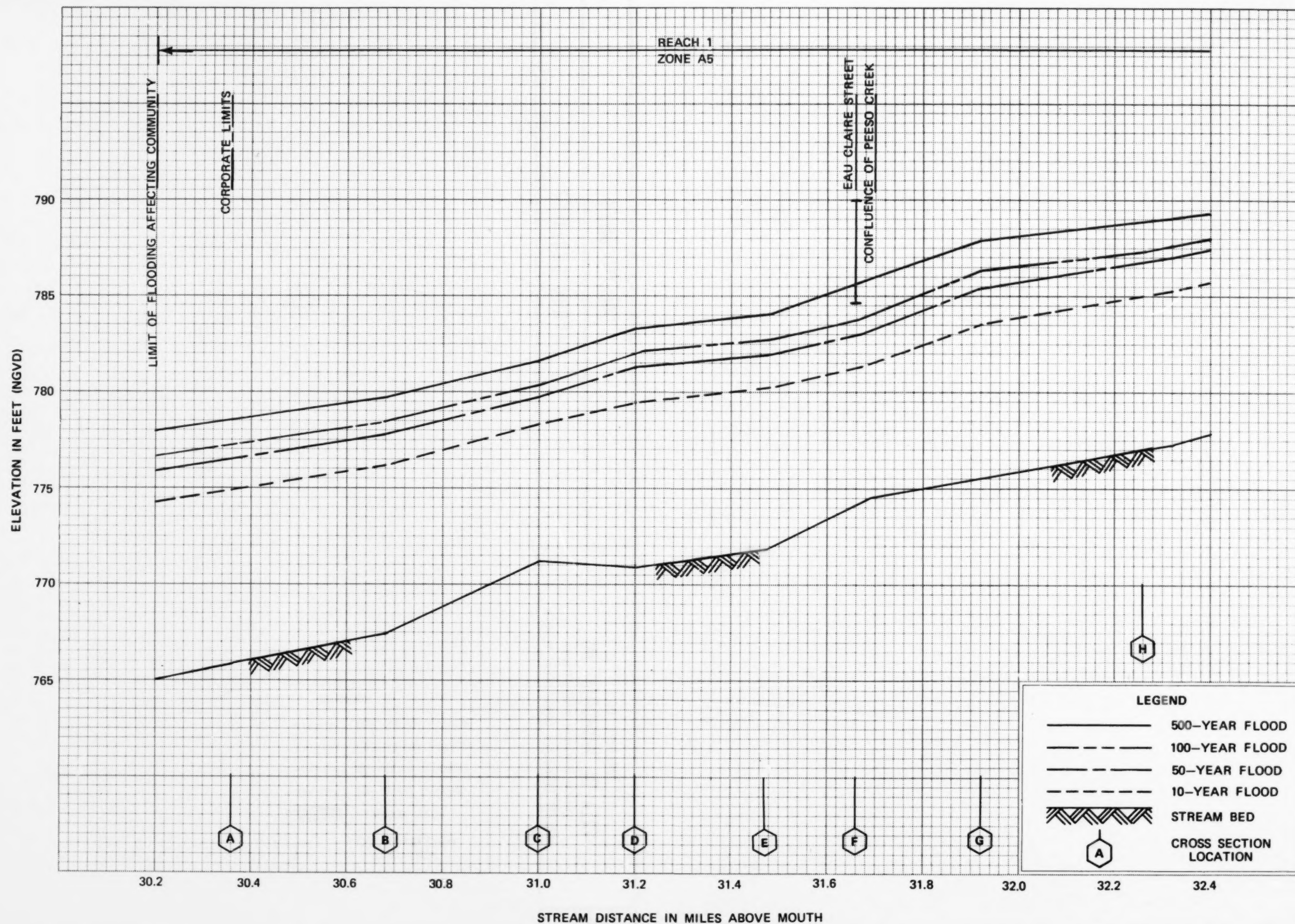
FLOOD INSURANCE ZONE DATA

BUFFALO RIVER - PEESO CREEK - BROWNLEE CREEK

TABLE 3

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10. Wisconsin Department of Natural Resources, Wisconsin's Flood Plain Management Program, Chapter NR 116, Register No. 159, 1977.

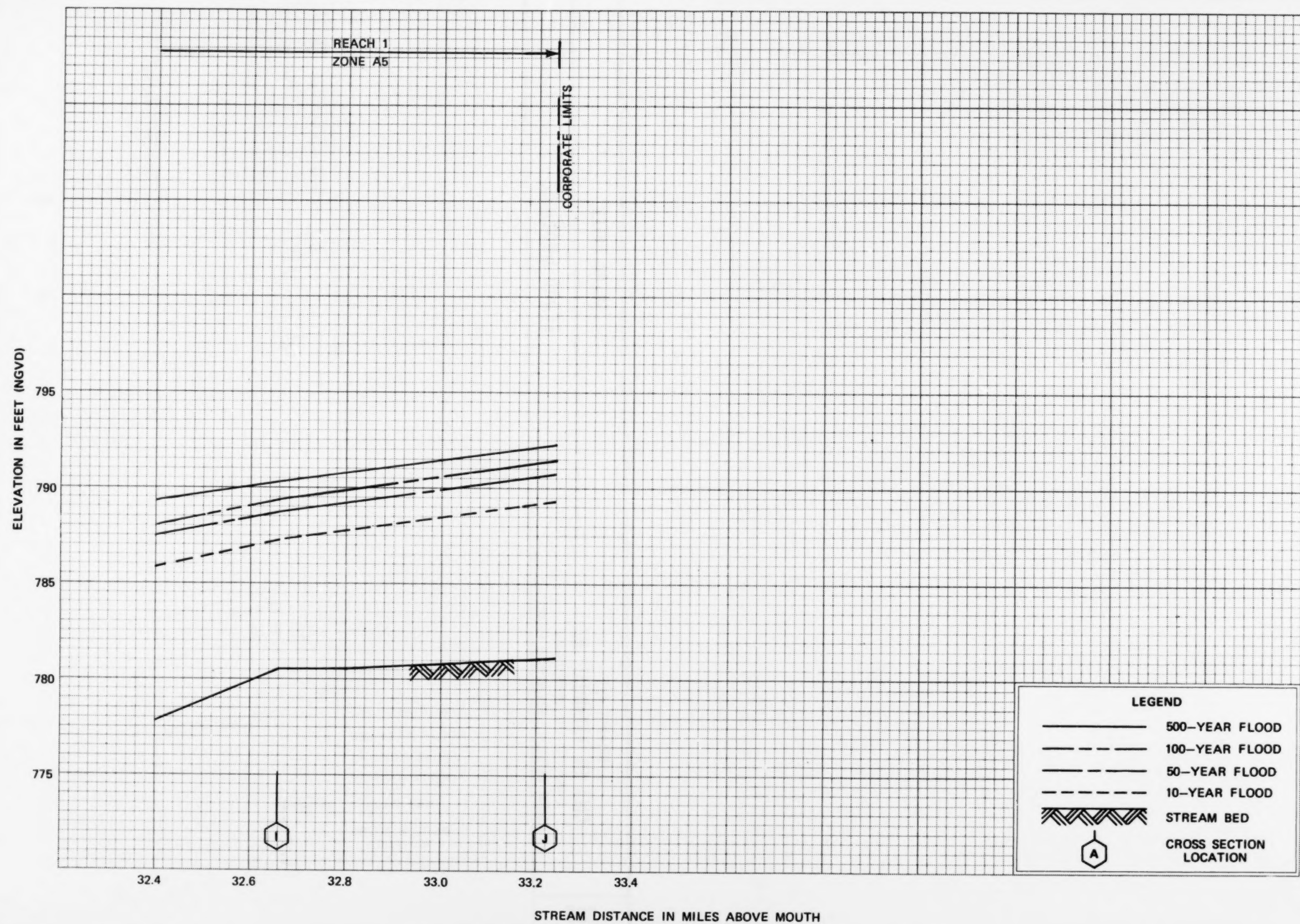


FLOOD PROFILES

BUFFALO RIVER

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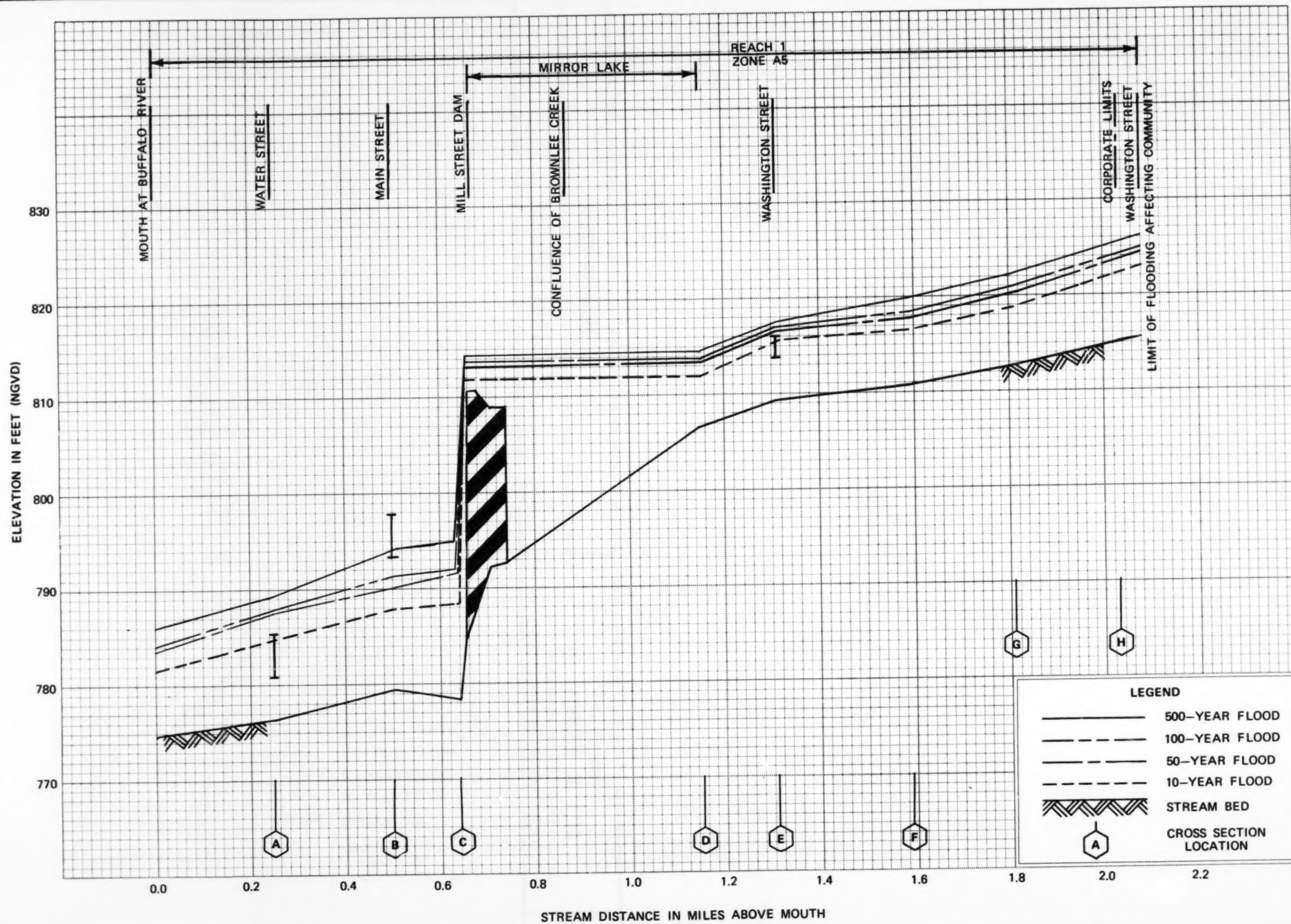
FLOOD PROFILES

BUFFALO RIVER

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02P

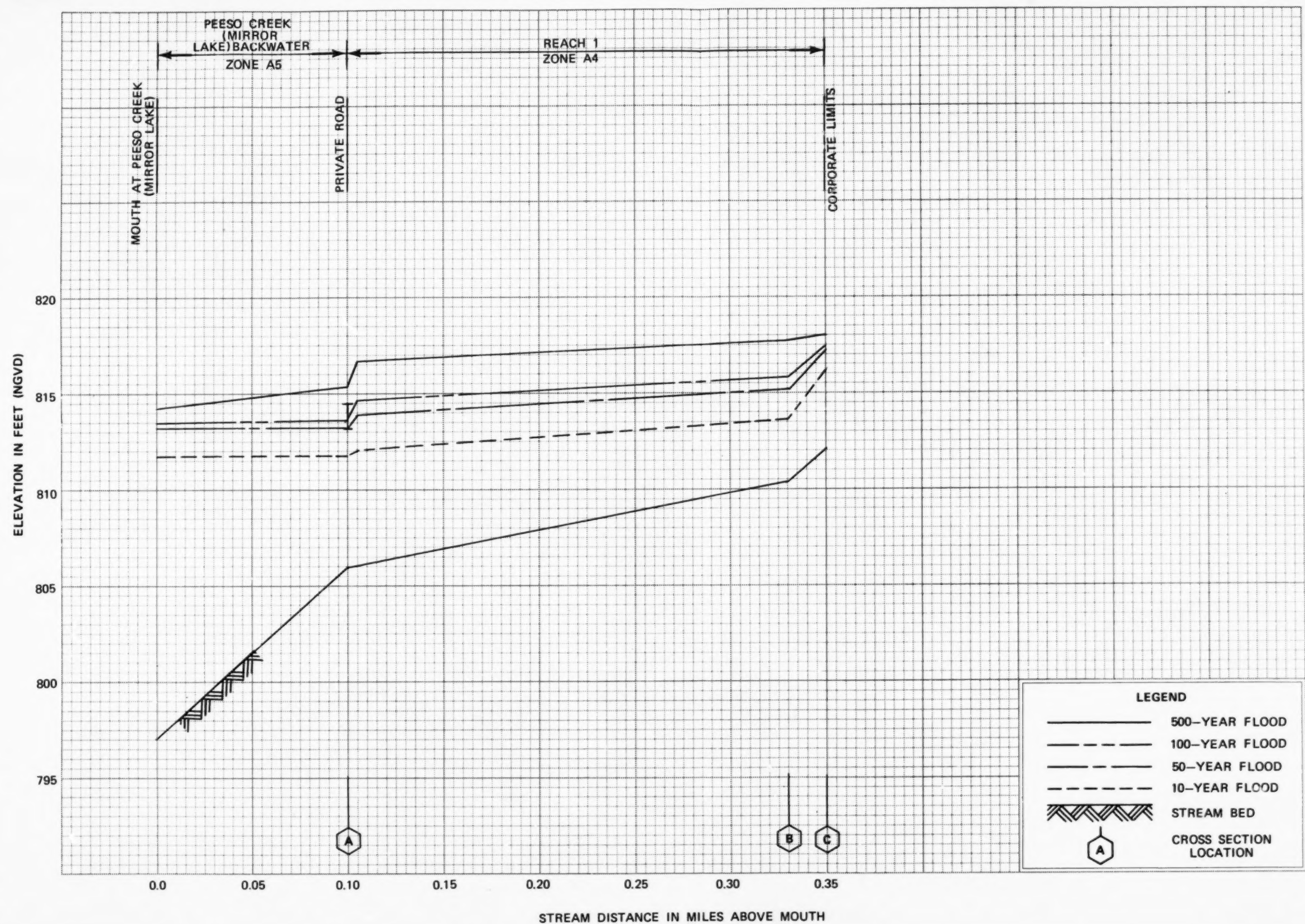


FLOOD PROFILES

PEESO CREEK

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03P



FLOOD PROFILES

BROWNLEE CREEK

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04P